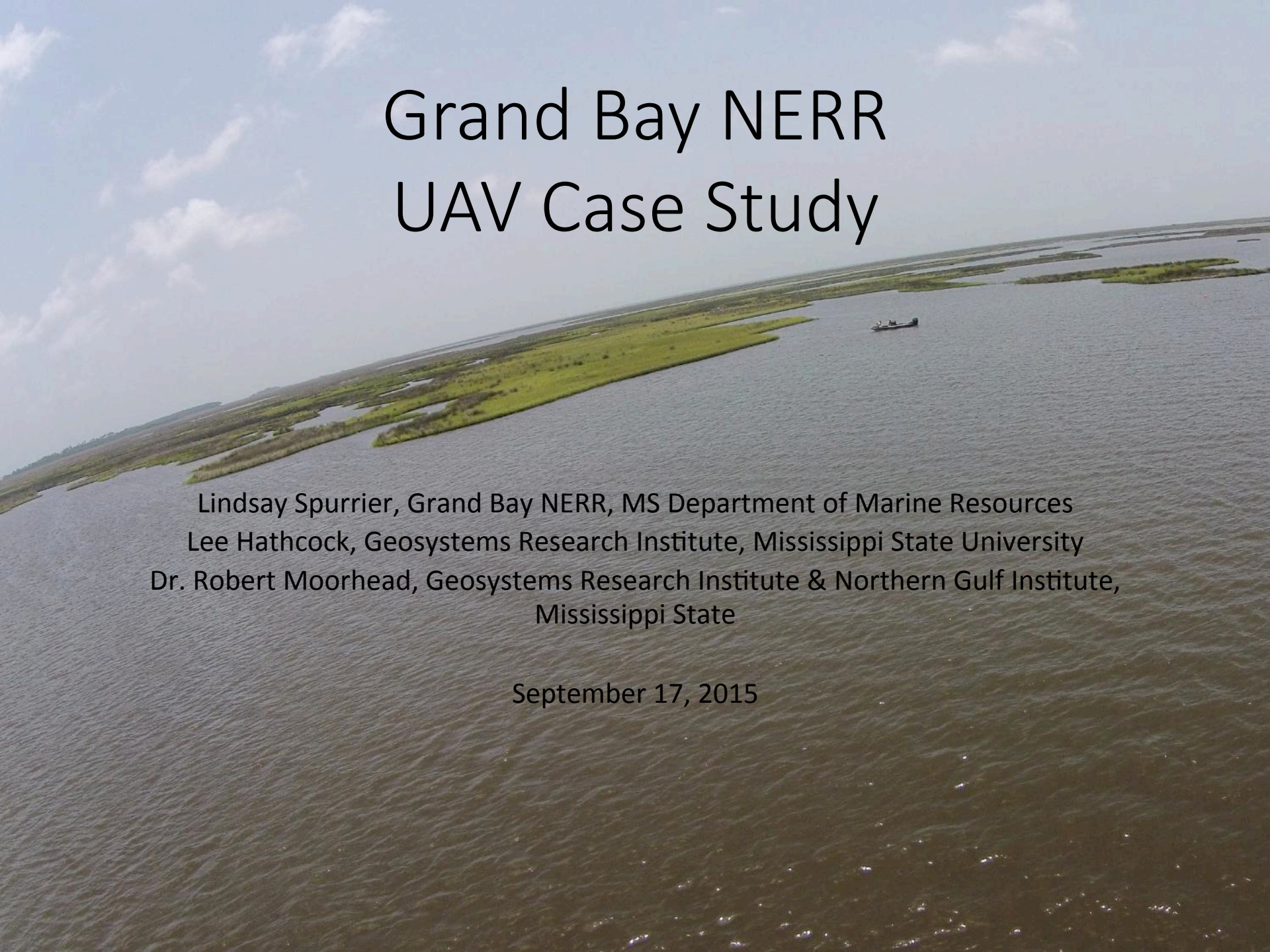
Grand Bay NERR
UAV Case Study



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Lee Hathcock, Geosystems Research Institute, Mississippi State University
Dr. Robert Moorhead, Geosystems Research Institute & Northern Gulf Institute, Mississippi State

September 17, 2015

Missions

Tradeoffs Study 03/20/2015

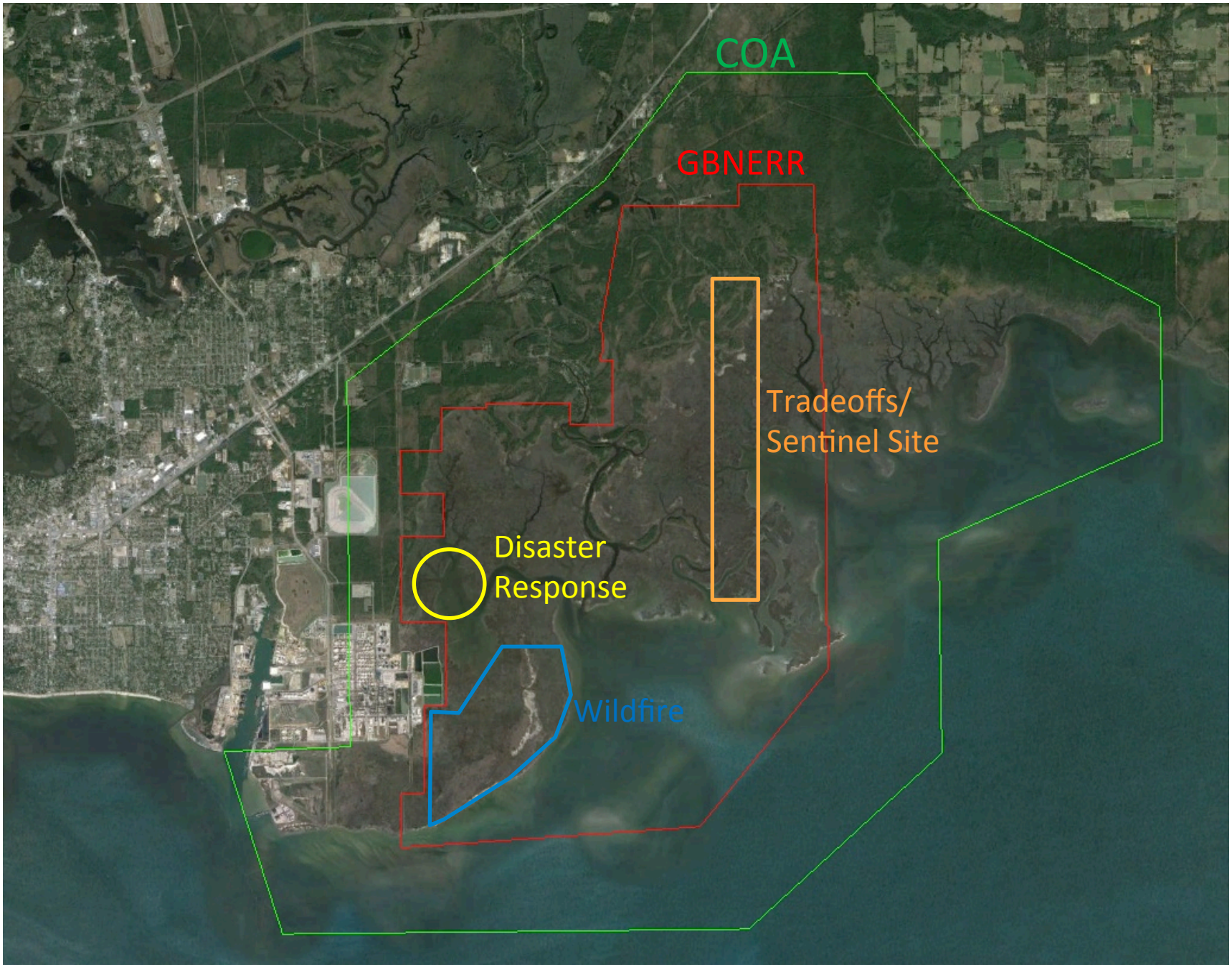
- Altavian Nova vs. MSU's Precision Hawk
- Coverage vs. Resolution
- Gauge collecting, processing and analyzing
- RGB vs. CIR (Color Infrared)

Sentinel Site 05/14/2015

- Differentiate *Spartina* and *Juncus*

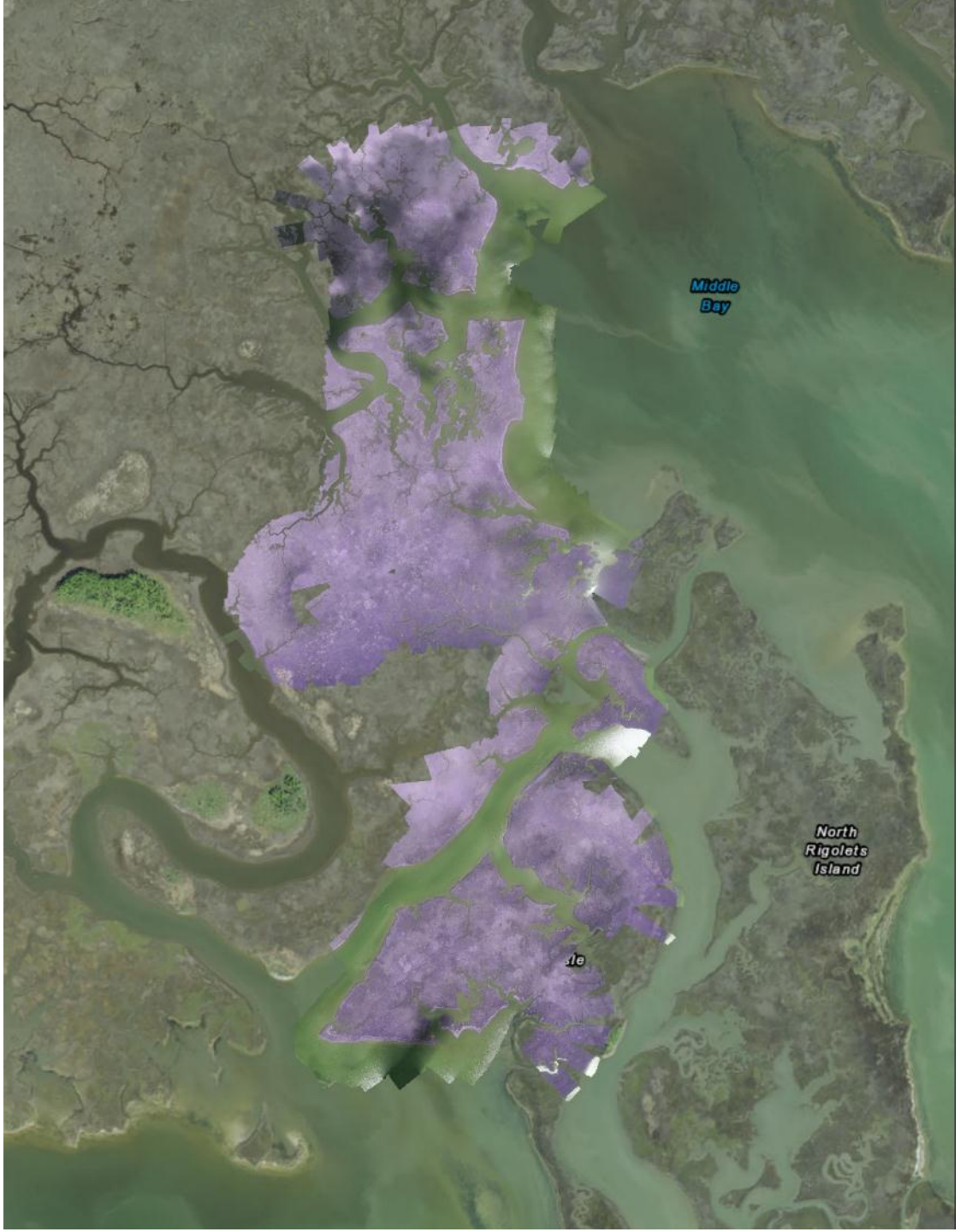
Disaster Response Exercise 06/30/2015

Wildfire Assessment 07/29/2015

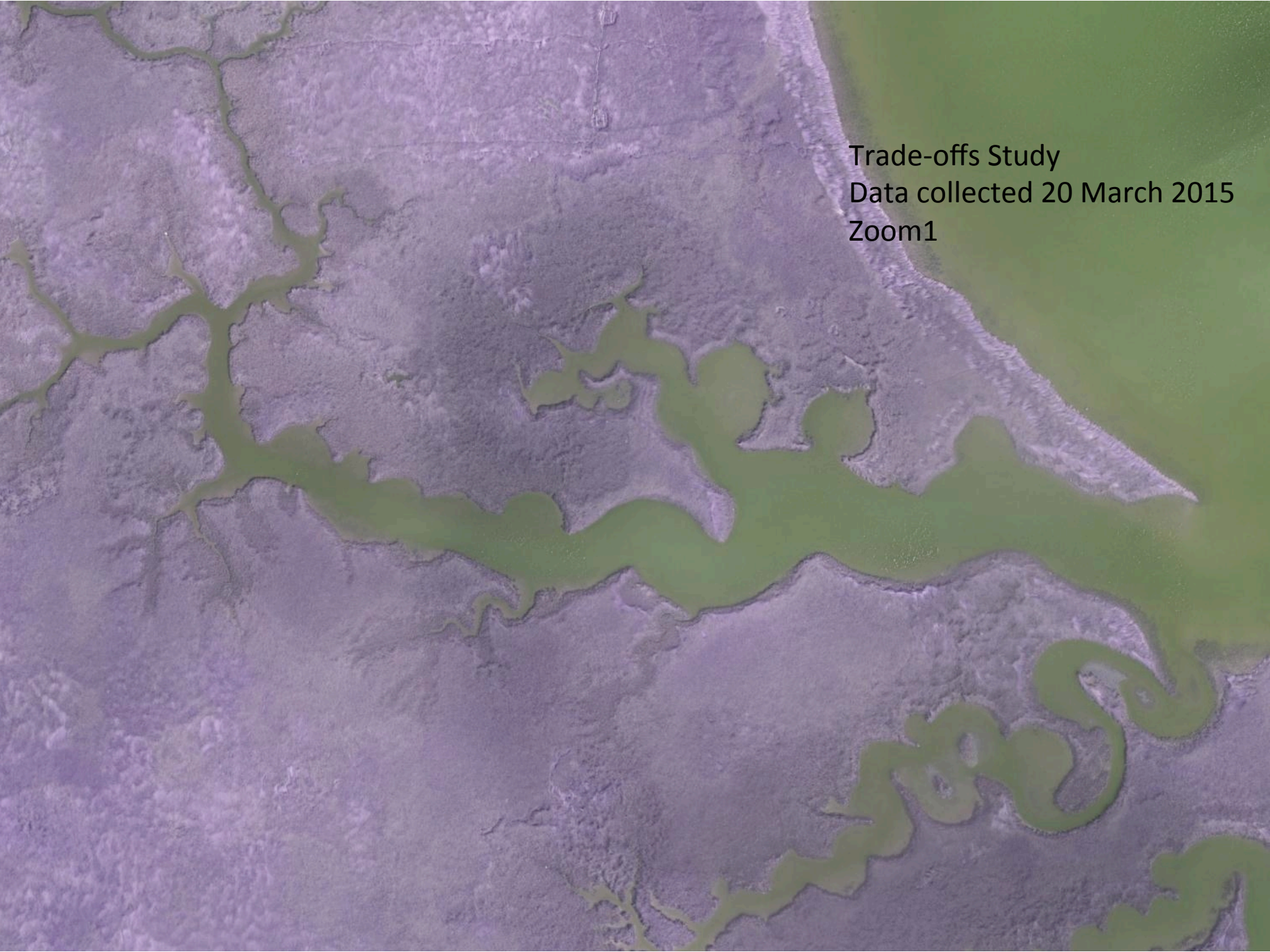

COA
GBNERR
Tradeoffs/
Sentinel Site
Disaster
Response
Wildfire

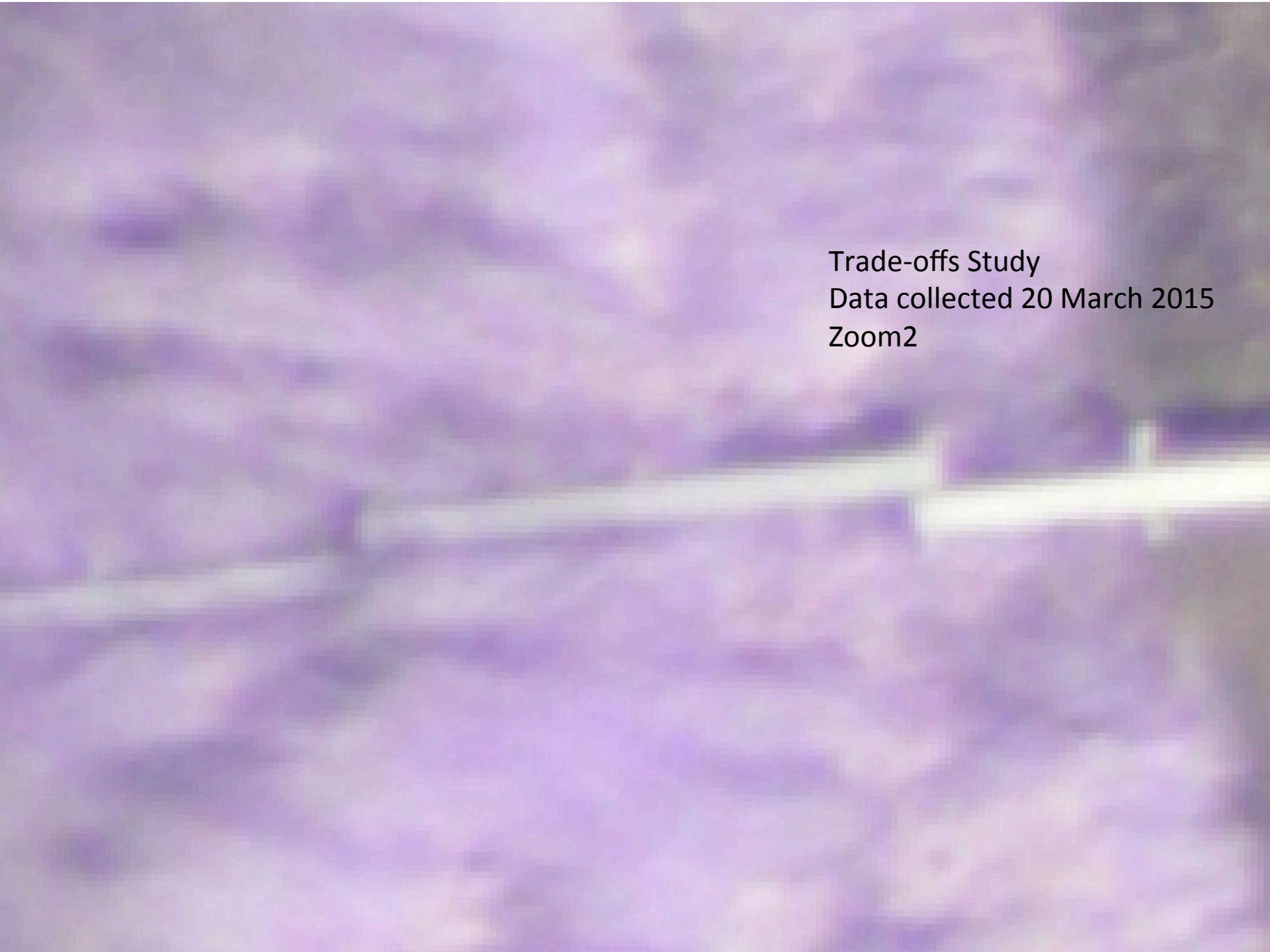
UAV Chart

Mission	UAV + Payload	Altitude (ft.)	GSD (in.)
Tradeoffs	Altavian Nova + CIR-modified Canon EOS Rebel SL1	510	1.3
Sentinel Site	PrecisionHawk Lancaster + CIR-modified Nikon J3	165	0.5
Disaster Response	DJI Phantom 2 Vision Plus	Various	Various
Wildfire Assessment	PrecisionHawk Lancaster + CIR-modified Nikon J3	590	2.0



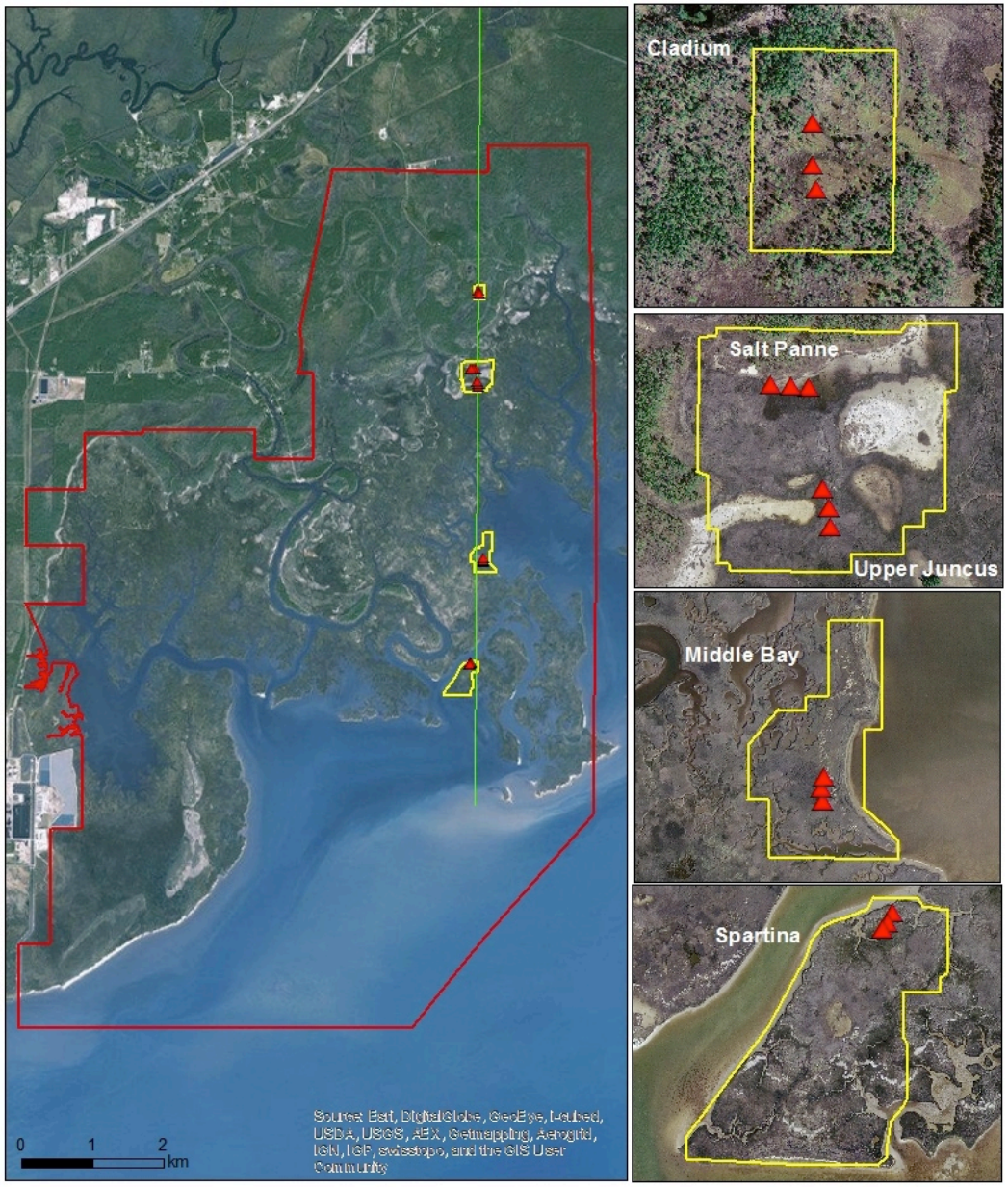
Trade-offs Study
Data collected 20 March 2015


Trade-offs Study
Data collected 20 March 2015
Zoom1


Trade-offs Study
Data collected 20 March 2015
Zoom2

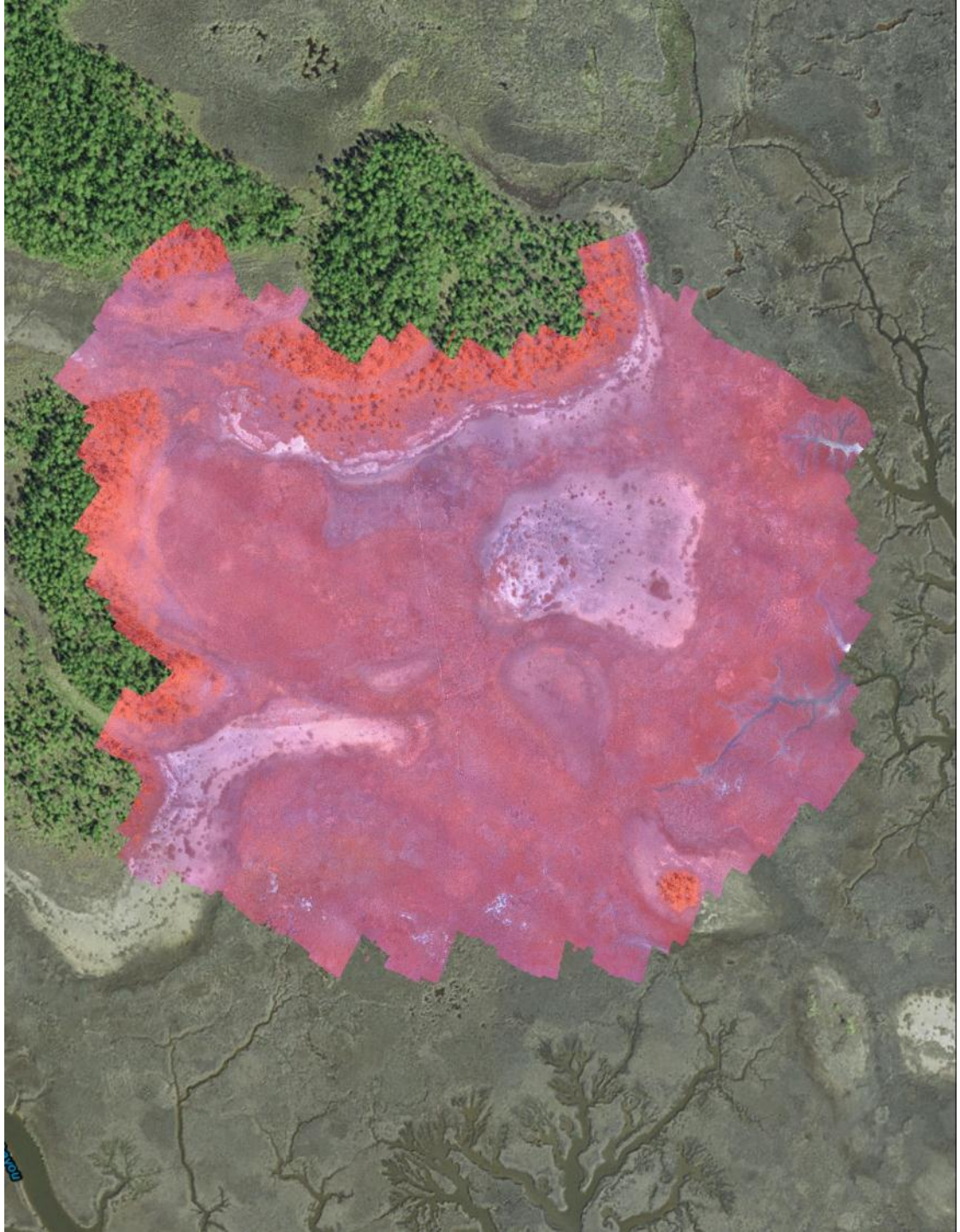
Tradeoffs Study
Post Mission Comments/Conclusions

- Payload: MSU's & Altavian's CIR payload are different. Altavian's CIR payload has larger FOV for more coverage per unit of time; less resolution; flight needs to be below ~500 ft
- GBNERR feedback: This imagery not that useful
- MSU's conclusion: Effort towards specific focused missions



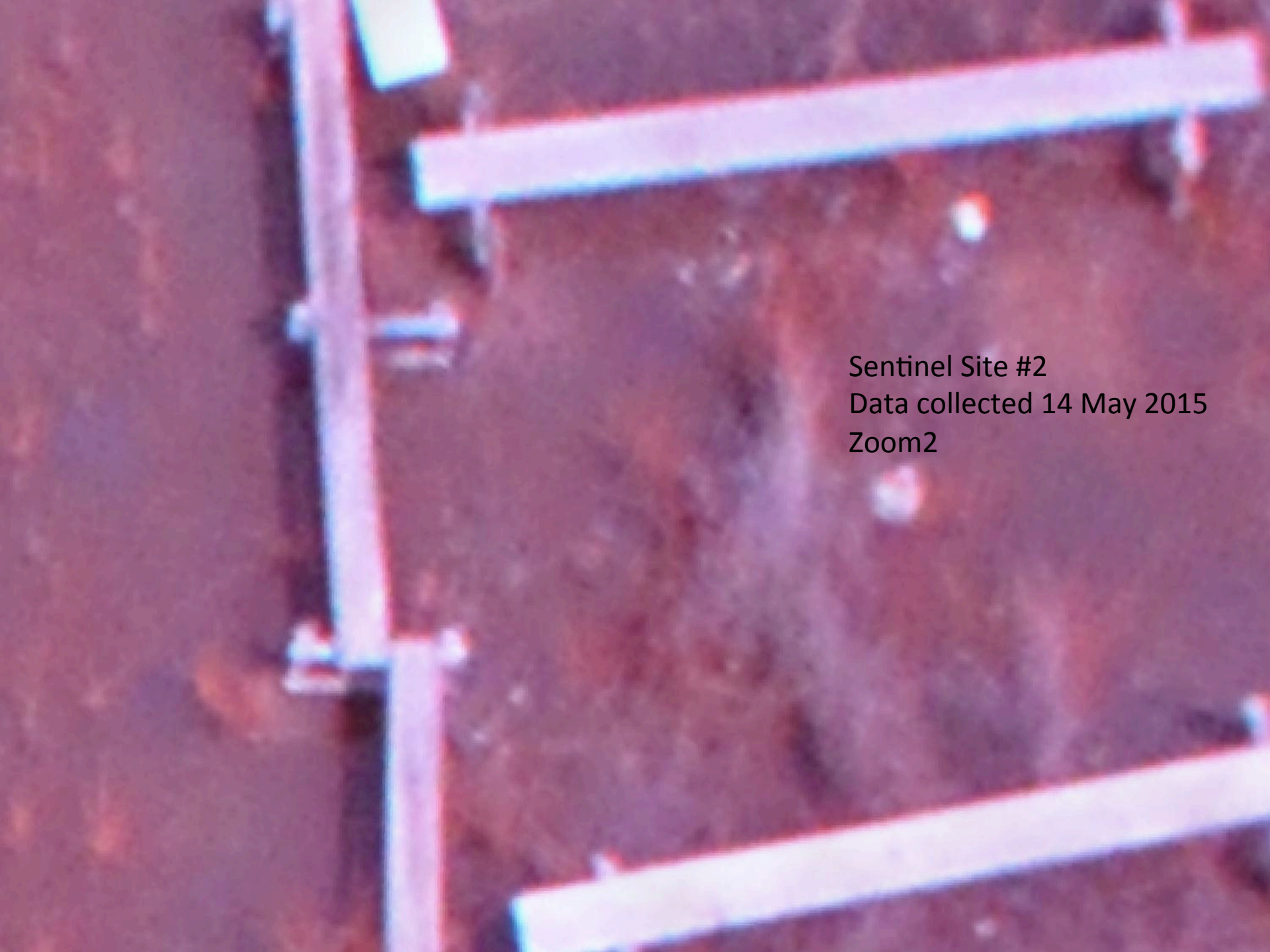
Sentinel Site Mission

Site	Area (mi^2)
Spartina SETs	0.062
Middle Bay SETs	0.046
Upper Juncus/Salt Panne SETs	0.078
Cladium SETs	0.011
SETs swath	5.87
Entire Reserve	29.06
Marsh within COA (not on map)	21



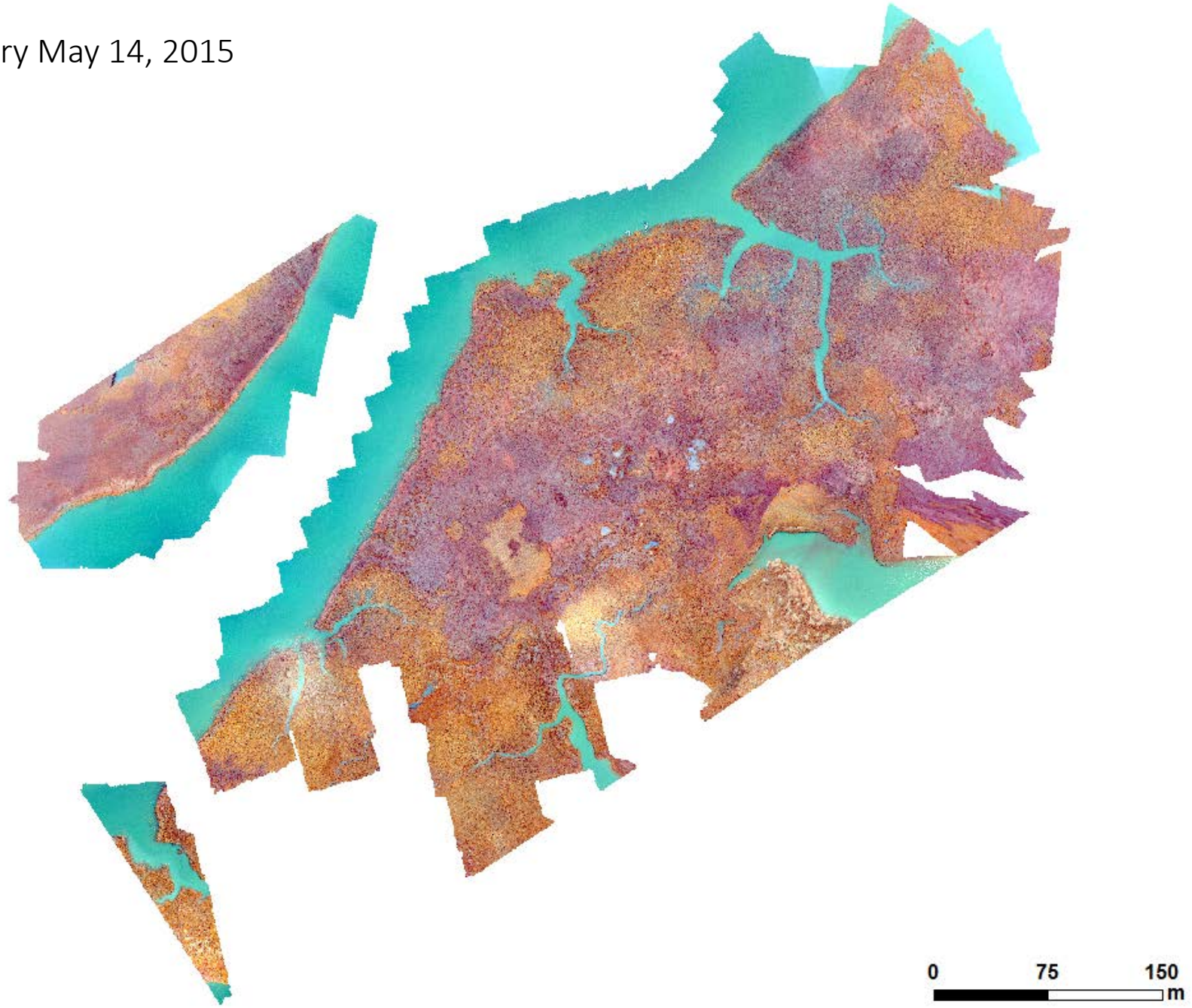
Sentinel Site #2
Data collected 14 May 2015


Sentinel Site #2
Data collected 14 May 2015
Zoom1


Sentinel Site #2
Data collected 14 May 2015
Zoom2

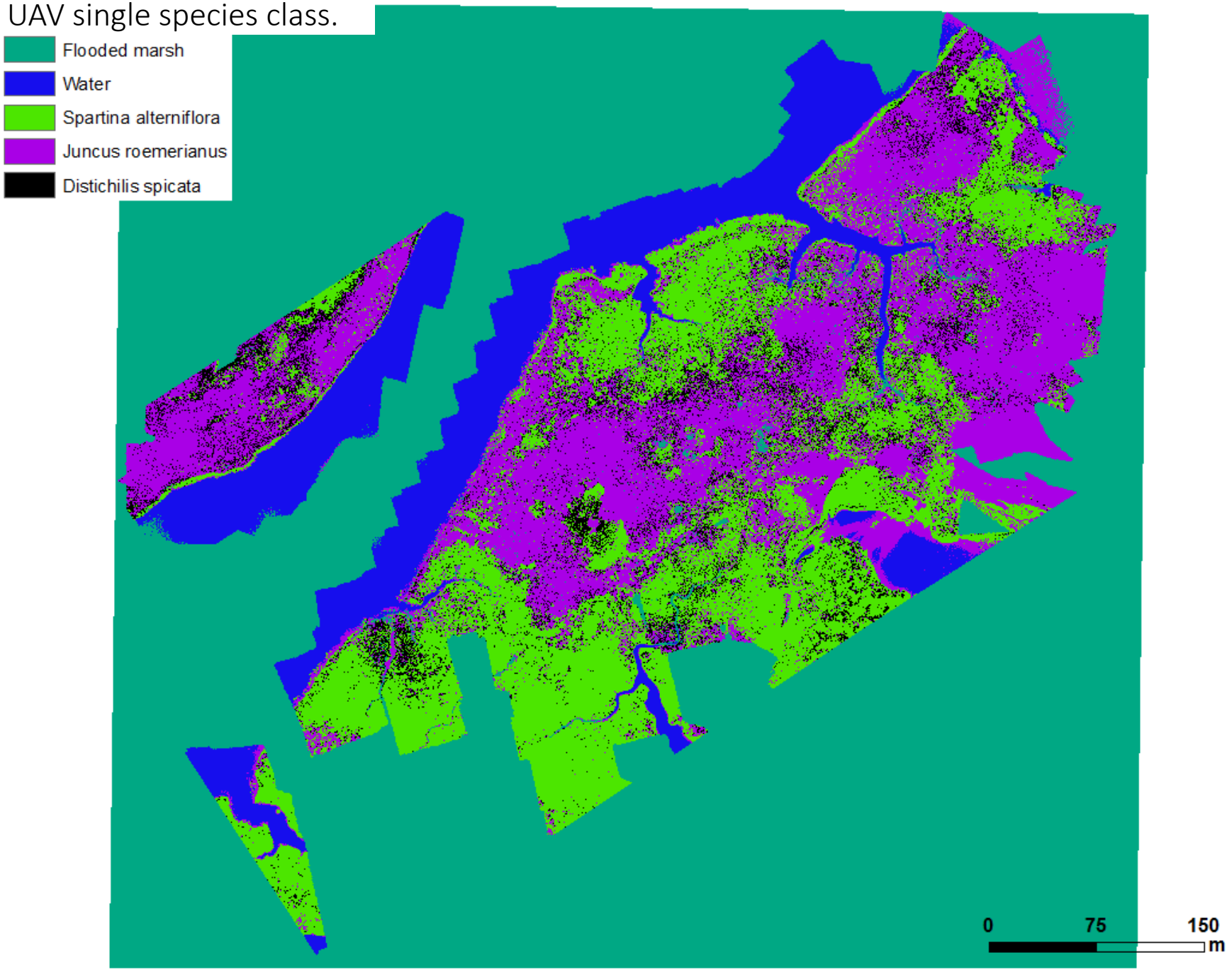

Sentinel Site #2
Data collected 14 May 2015
Zoom3

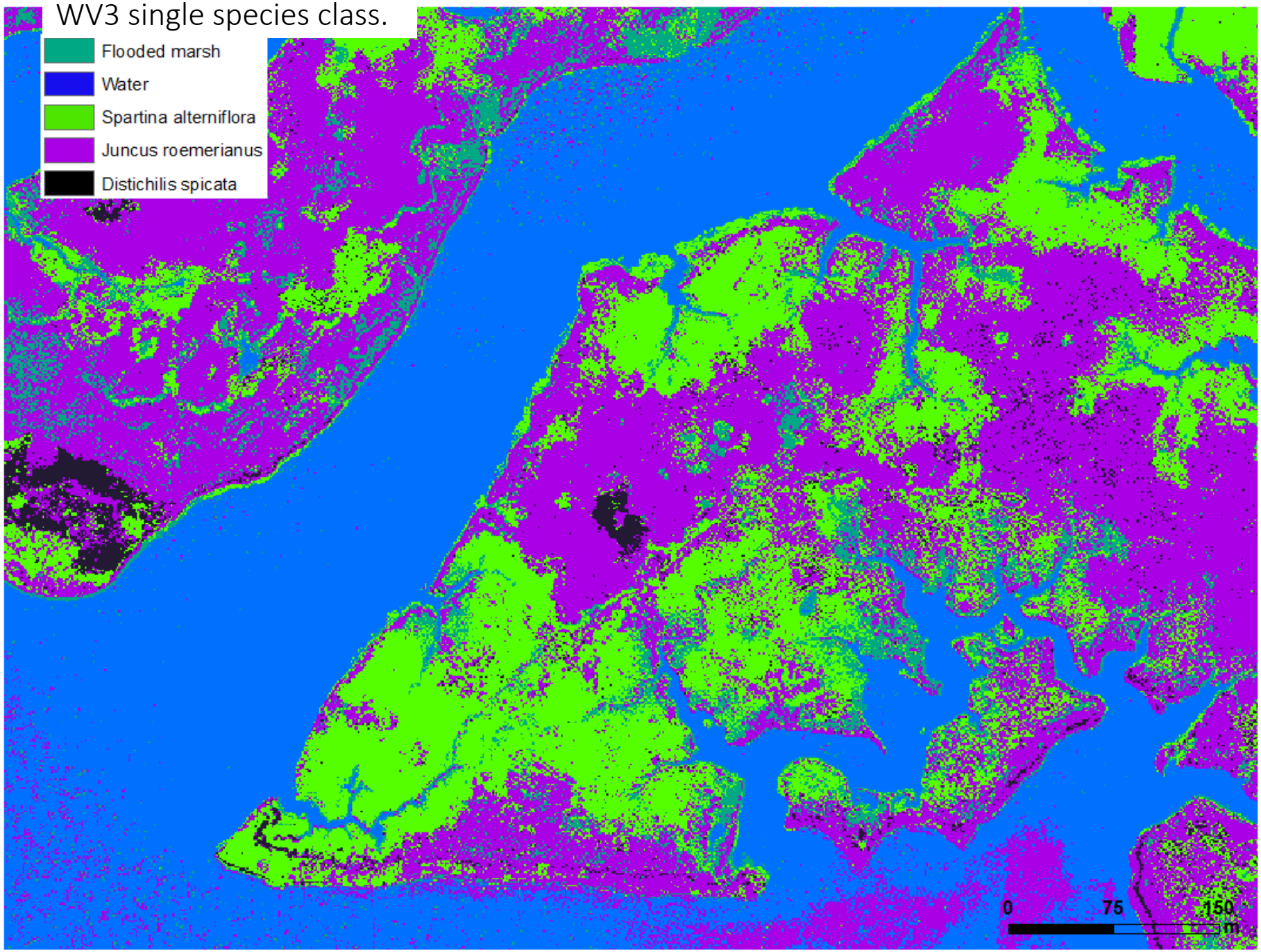
UAV imagery May 14, 2015

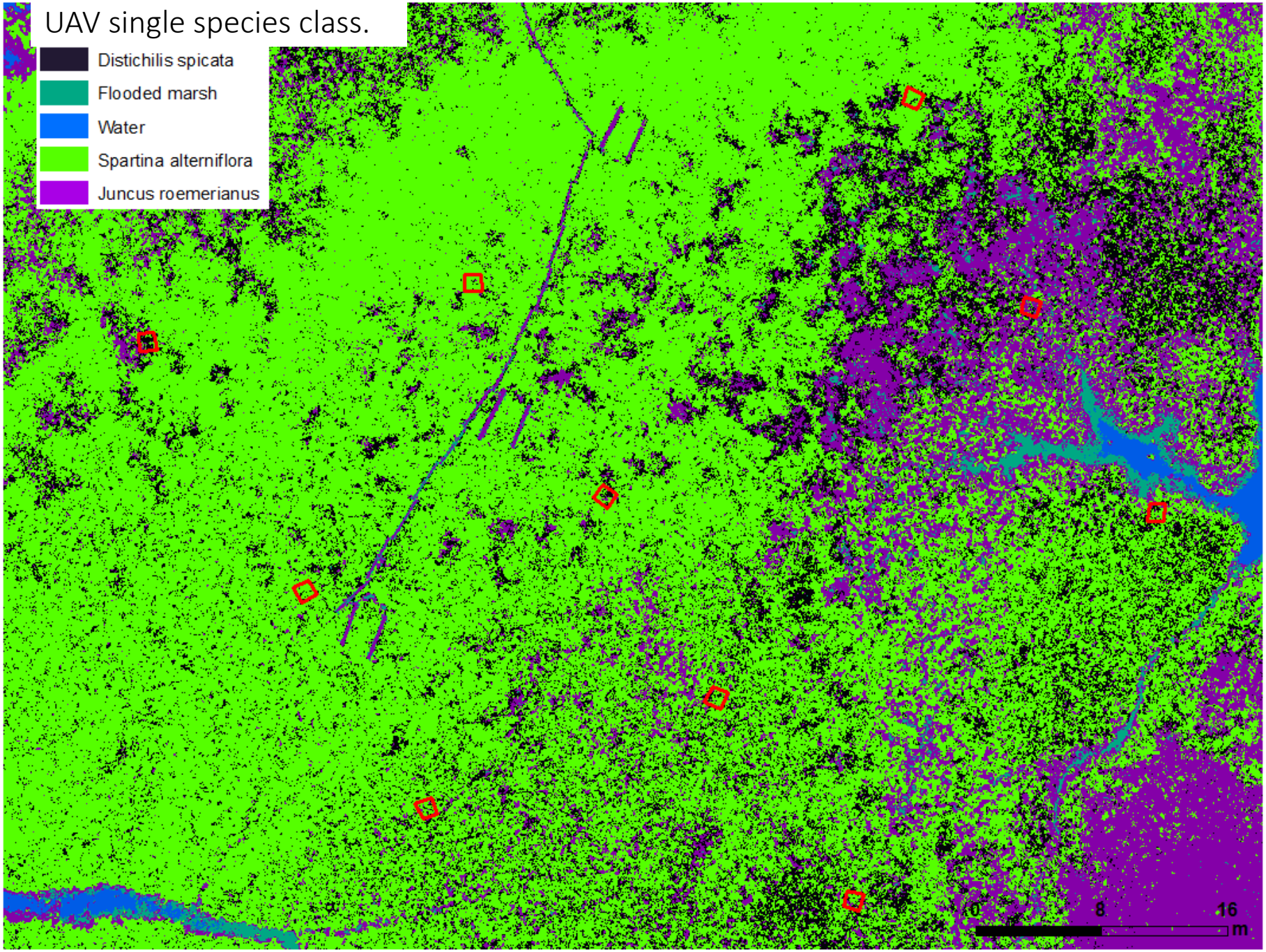


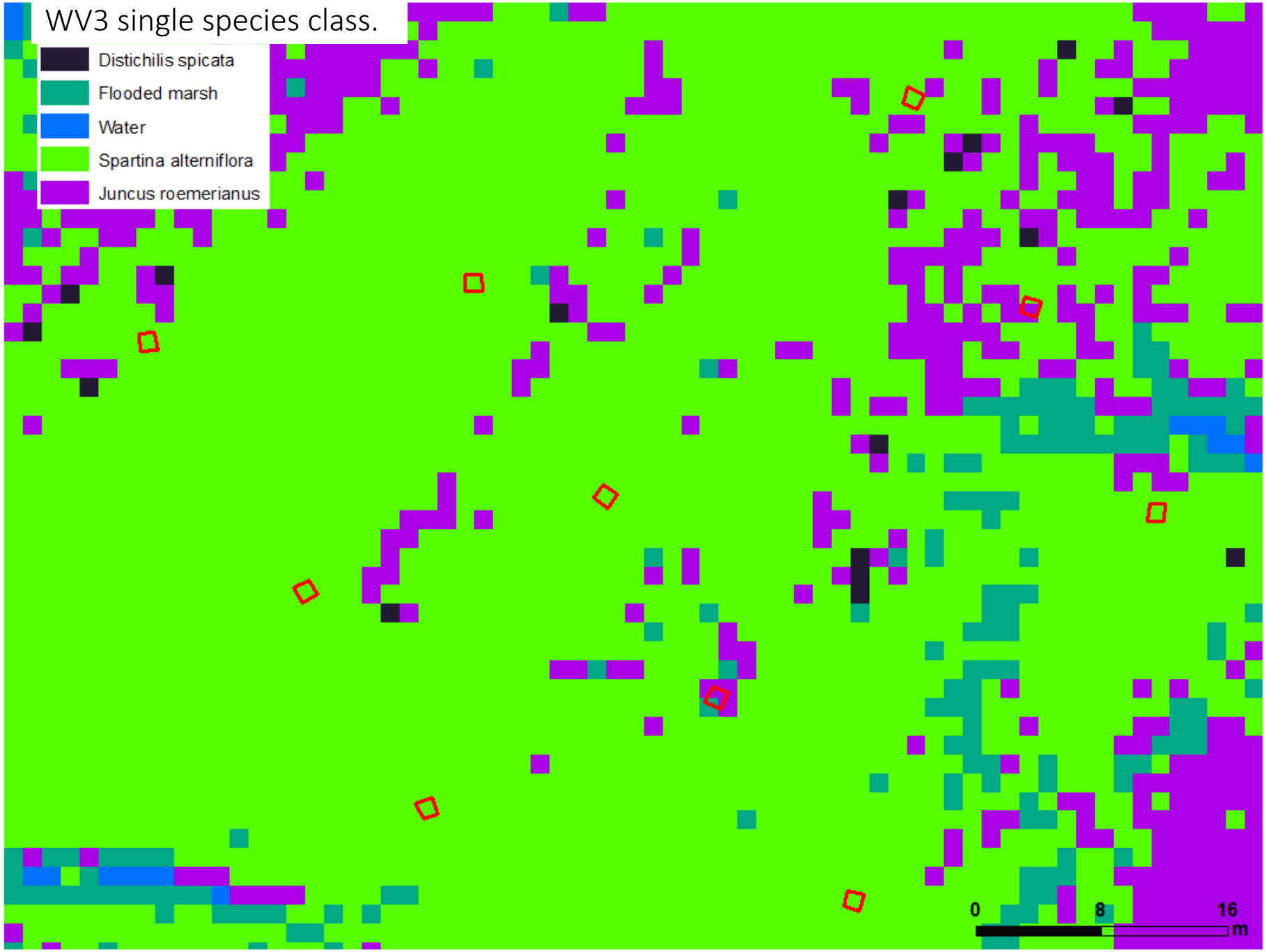

WV3 imagery May 3, 2015
0
75
150
m

UAV single species class.




WV3 single species class.
Flooded marsh
Water
Spartina alterniflora
Juncus roemerianus
Distichilis spicata
0
75
150
m


UAV single species class.
Distichilis spicata
Flooded marsh
Water
Spartina alterniflora
Juncus roemerianus
0
8
16
m

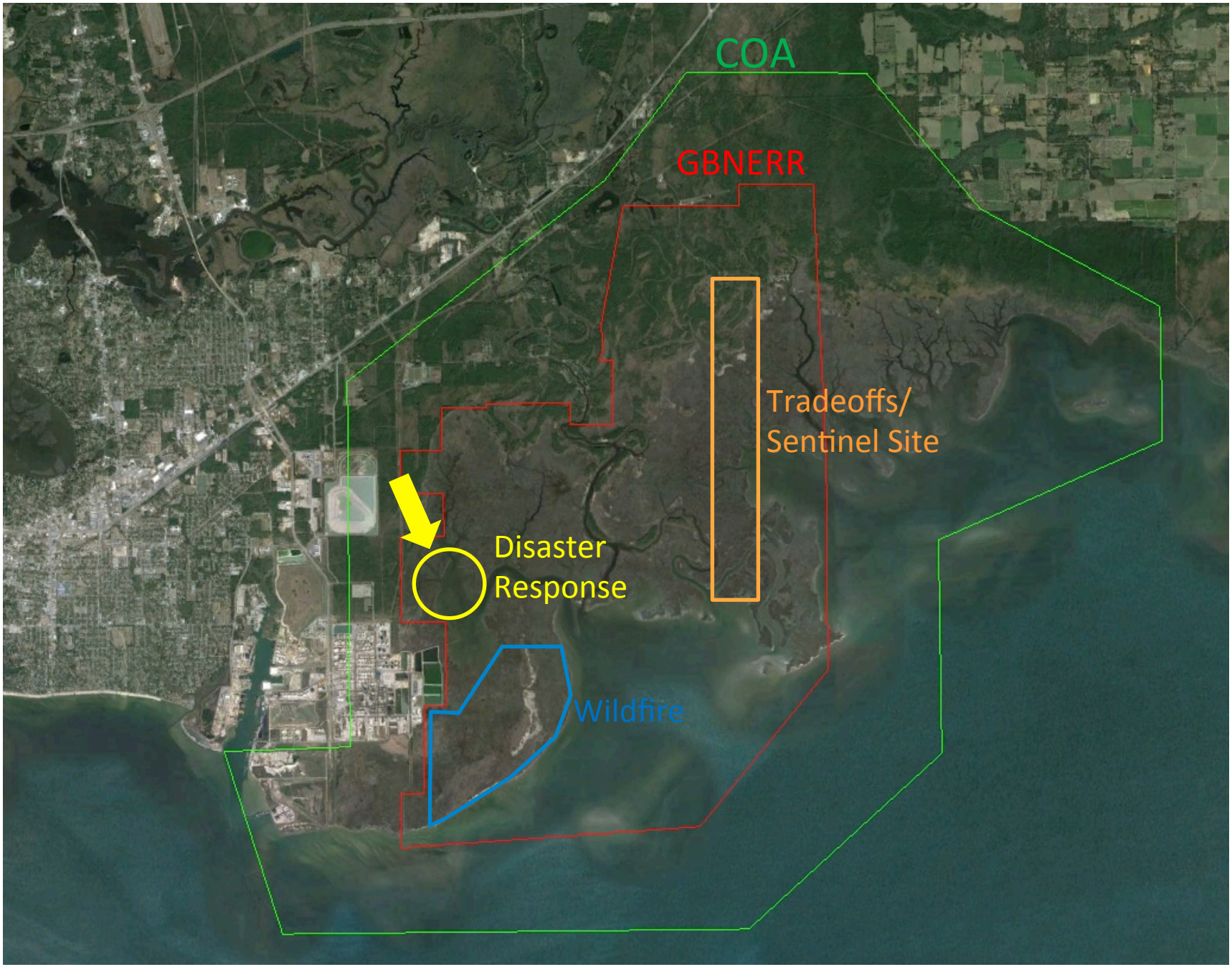

WV3 single species class.
Distichilis spicata
Flooded marsh
Water
Spartina alterniflora
Juncus roemerianus
0
8
16
m

Sentinel Site
Post Mission Comments

- Payload: MSU's CIR payload great resolution, covering Sentinel Site areas in 1 field day, smaller FOV not an issue
- GBNERR feedback: The imagery is sufficient for single species mapping, comparable to vegetation plots. Need to fly again next spring/summer for change assessment.

Simulated Chemical Spill

- Simulate chemical spill from Mississippi Phosphates plant
- Bangs Lake area
- Multi-university and multi-agency team
  - GBNERR personnel
  - NGI: USM, DISL, MSU
  - Mississippi Department of Marine Resources
  - NOAA Disaster Response Center
  - Local television documented
- MSU task: Monitor the release of Fluorescein dye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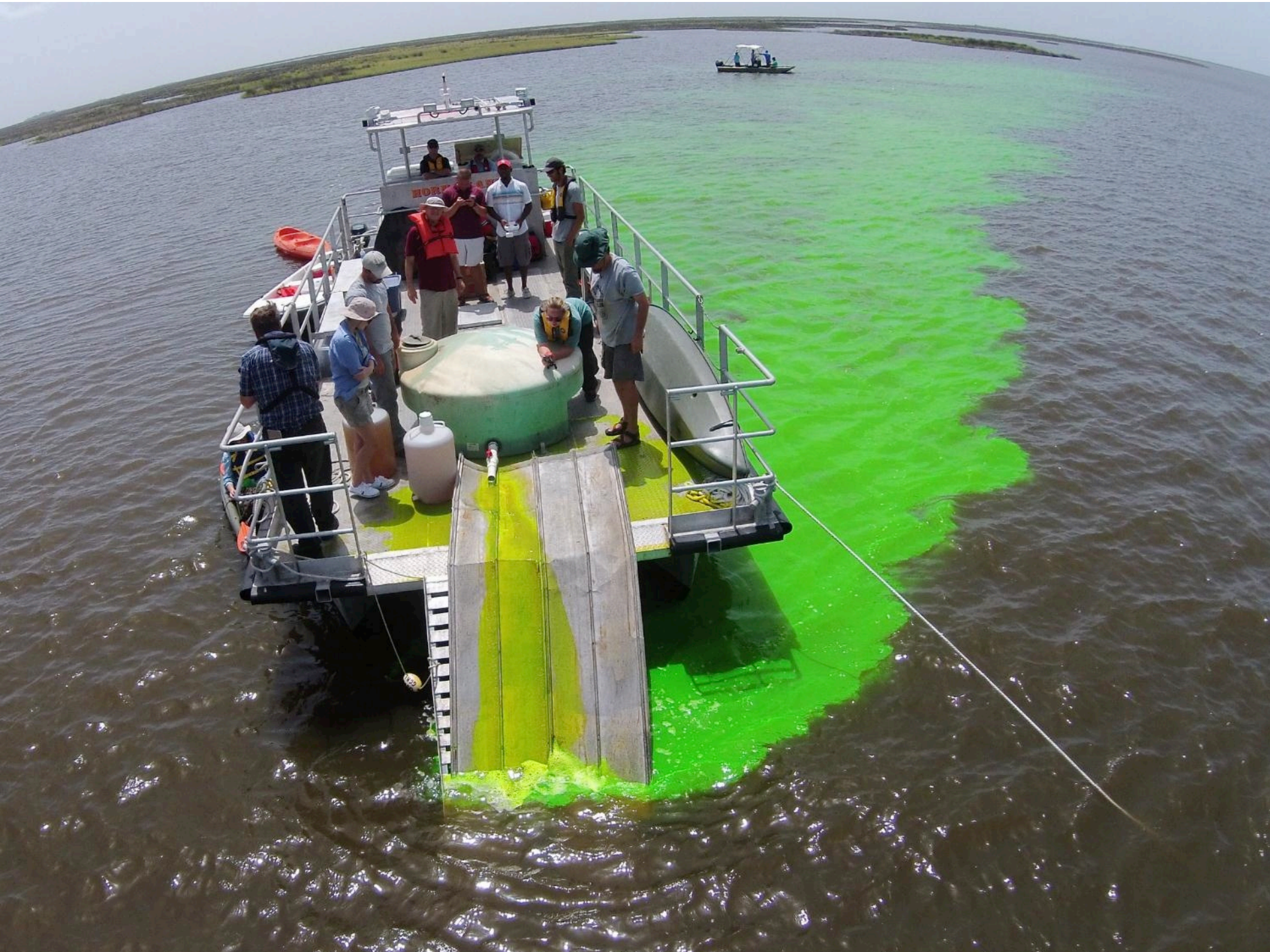
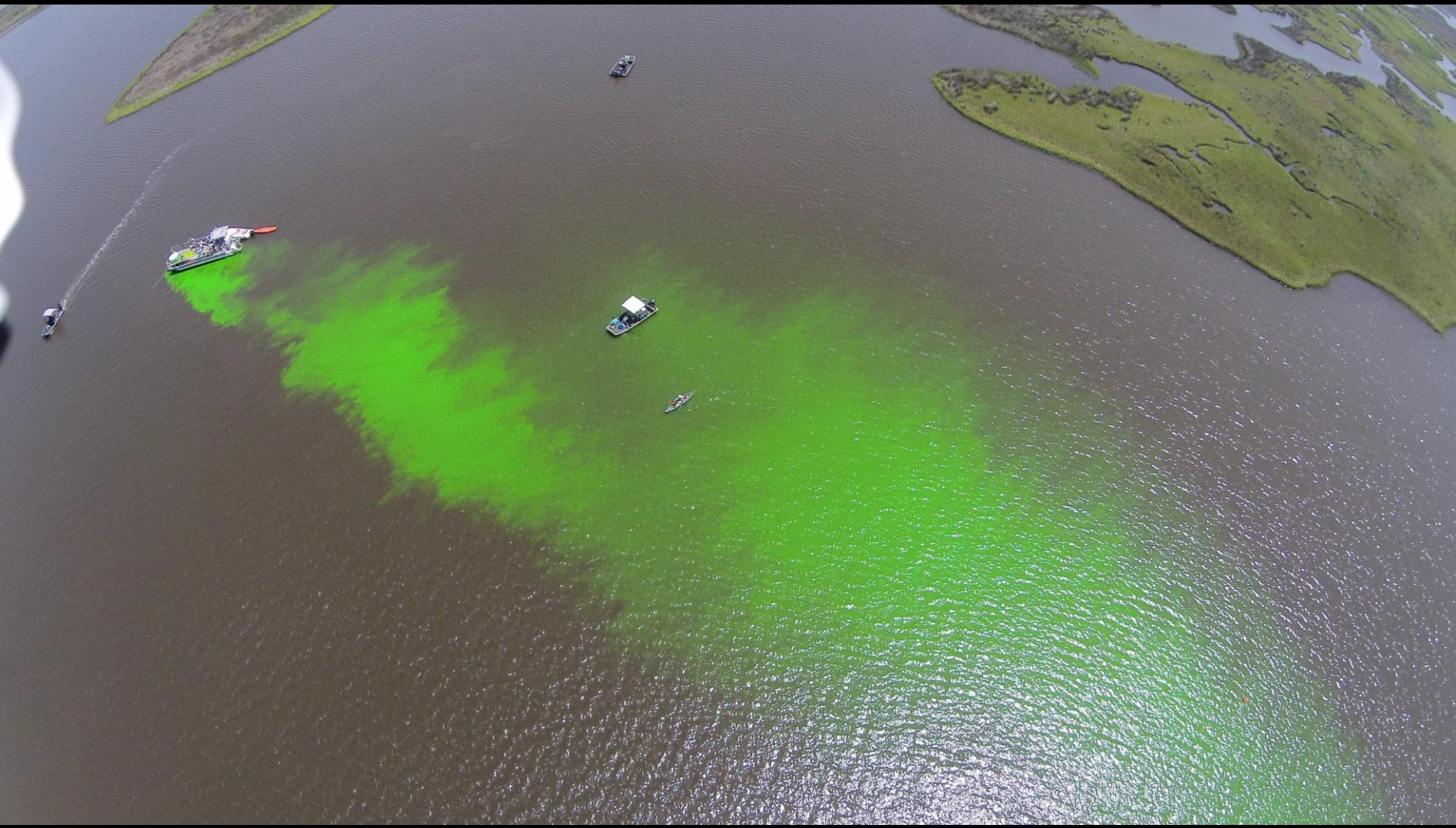
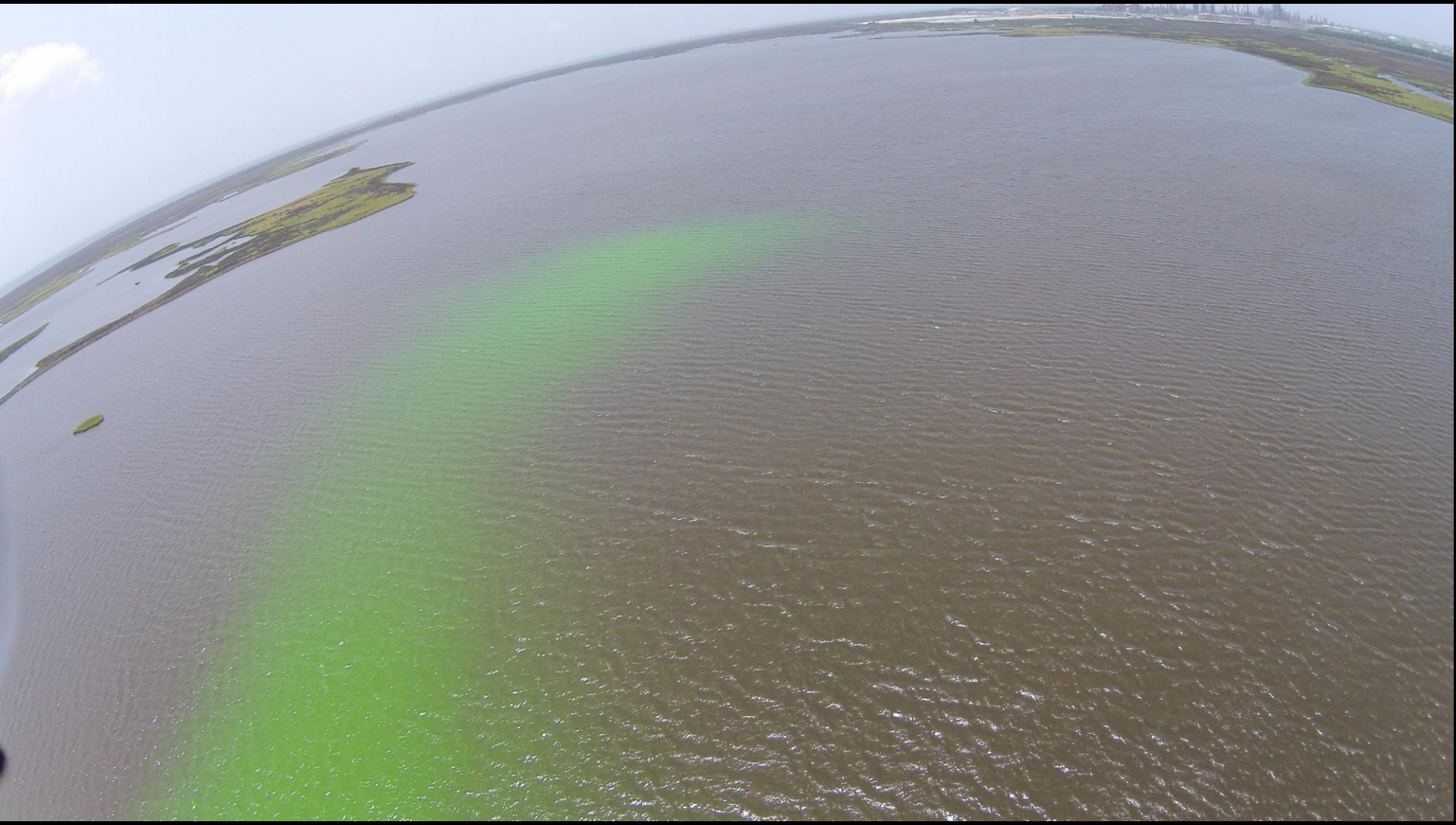
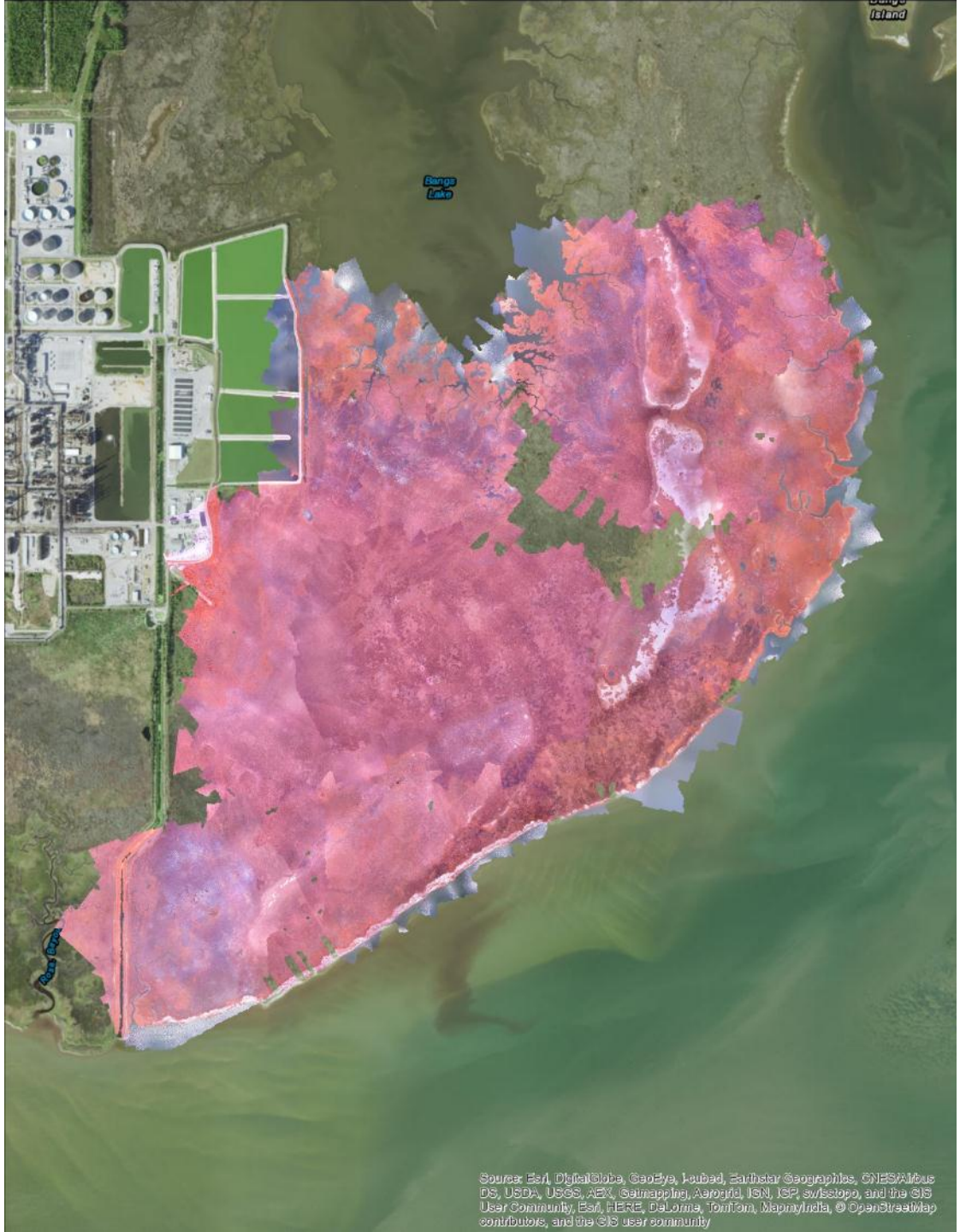






Marsh Fire Mission

- Determine conditions in area immediately after fire
- ~1700 acres
- Plan to monitor (re-fly) as vegetation regrows
- Two MSU employees executed mission. One GBNERR person provide transportation to site.
- Precision Hawk was a bit small. Needed bigger plane to cover more area per unit time and to deal with wind.



Marsh Fire Area
Data collected 29 July 2015

Summary

- It takes a shed full of tools and a team of people to accomplish the varied missions in a NERR. Would suggest a small fixed wing (e.g., Precision Hawk), a larger fixed wing (Altavian Nova or bigger), and at least one multi-rotor copter. Need multiple payloads (visible, multispectral, …). Strongly suggest bringing in a team with tools for most UAV projects.
- UAV are VERY beneficial tools to the NERR mission.
- The GBNERR folks have been great to work with. Would enjoy working with other NERRs with similar folks and interests.
- Unmanned Aerial Systems (UAS) Imagery Acquisition Roadmap